

## Swift Observation of GRB 121108A

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### 1 Introduction

BAT triggered (Trigger 537921) on GRB 121108A at 17:47:39 UT (Ukwatta et al., 2012). Swift slewed immediately to the burst. This was a  $12.92\sigma$  rate-trigger on a burst with  $T_{90} = 89 \pm 48$  sec. The XRT began observing the field at 17:48:33.2 UT, 54.2 seconds after the BAT trigger. XRT found a bright, fading, uncatalogued X-ray source. The UVOT started settled observations 64 seconds after the trigger and no optical afterglow was detected. Our best position is the enhanced XRT position at  $RA(J2000) = 83.19408$  deg (05h 32m 46.58s),  $Dec(J2000) = +54.47352$  deg (+54d 28' 24.7") with an uncertainty of 1.8 arcsec (90% confidence).

### 2 BAT Observation and Analysis

Using the data set from  $T - 240$  to  $T + 962$  sec, further analysis of BAT GRB 121108A has been performed by BAT team (Baumgartner et al., 2012). The BAT ground-calculated position is  $RA(J2000) = 83.216$  deg (05h 32m 51.9s),  $Dec(J2000) = 54.520$  deg (+54d 31' 11.2")  $\pm 2.2$  arcmin, (radius, systematic and statistical, 90% containment). The partial coding was 90% (the boresight angle was 11.7 deg).

BAT light curve (Fig. 1) shows two multi-peak episodes. First one starts at the trigger time and lasts for about 50 seconds and the second weak episode starts around  $T + 130$  seconds and lasts for about 40 seconds.  $T_{90}$  (15-350 keV) is  $89 \pm 48$  sec (estimated error including systematics).

The time-averaged spectrum from  $T - 0.15$  to  $T + 137.98$  sec is best fit by a simple power-law model. The power law index of the time-averaged spectrum is  $2.28 \pm 0.20$ . The fluence in the 15 – 150 keV band is  $9.6 \pm 1.2 \times 10^{-07}$  erg cm<sup>-2</sup>. The 1-sec peak photon flux measured from  $T + 43.18$  sec in the 15 – 150 keV band is  $1.6 \pm 0.2$  ph cm<sup>-2</sup> sec. All the quoted errors are at the 90% confidence level.

The results of the batgrbproduct analysis are available at [http://gcn.gsfc.nasa.gov/notices\\_s/537921/BA/](http://gcn.gsfc.nasa.gov/notices_s/537921/BA/)

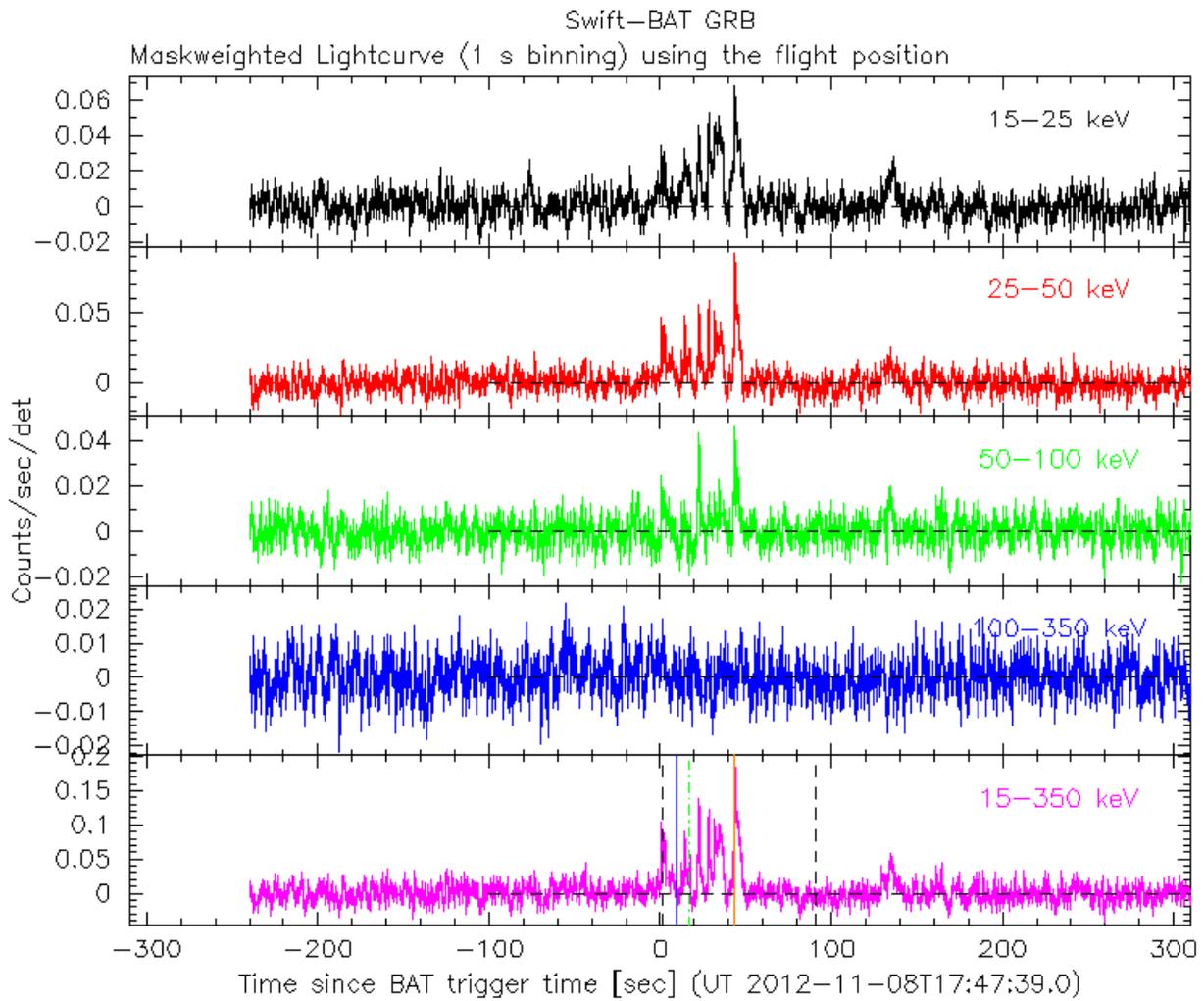


Figure 1: The mask-weighted light curve in the 4 individual plus total energy bands. The units are counts/sec/illuminated-detector and  $T_0$  is 17:47:39 UT.

### 3 XRT Observations and Analysis

XRT data were collected from  $T + 47$  s to  $T + 82.6$  ks after the BAT trigger (Melandri et al., 2012). The data comprise 129 s in Windowed Timing (WT) mode (the first 6 s were taken while Swift was slewing) with the remainder in Photon Counting (PC) mode. The enhanced XRT position (Beardmore et al., 2012) for this burst is: RA, Dec = 83.19408, +54.47352 which is equivalent to:

RA (J2000): 05h 32m 46.58s

Dec (J2000): +54d 28' 24.7"

with an uncertainty of 1.8 arcsec (radius, 90% confidence).

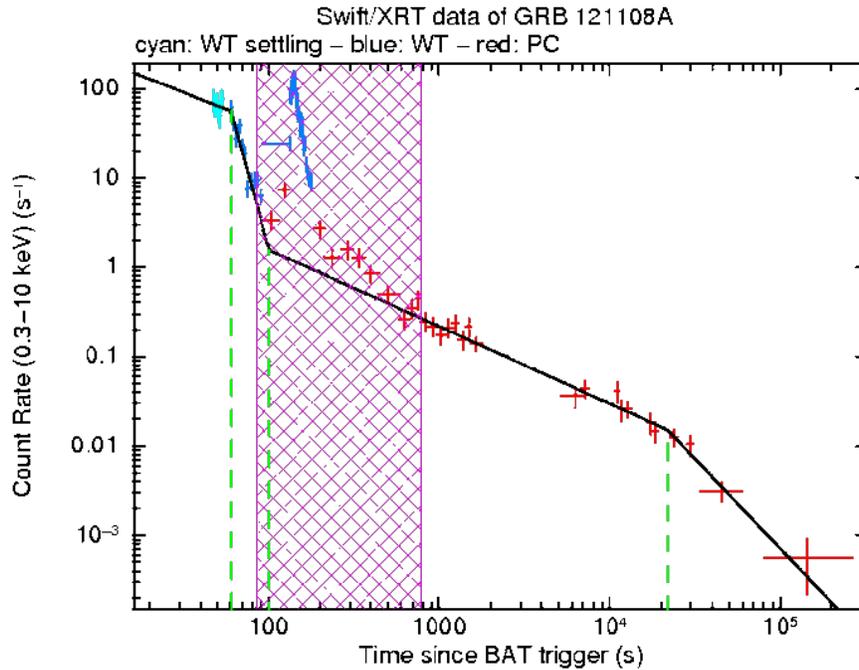


Figure 2: XRT Lightcurve. Count rate in the 0.3–10 keV band is plotted with Window Timing (WT) mode data in blue, WT Settling data in light blue and Photon Counting (PC) mode data in red. The approximate conversion is 1 count/sec =  $\sim 4.6 \times 10^{-11}$  ergs/cm<sup>2</sup>/sec.

The X-ray light curve from  $T + 0.8$  ks (Fig. 2) can be modelled with a power-law decay with a decay index of  $\alpha = 1.0 \pm 0.1$ . Flare activity is detected from  $T + 100$  and  $T + 200$  sec after the burst event.

A spectrum formed from the WT mode data can be fitted with an absorbed power-law with a photon spectral index of  $1.60 \pm 0.09$ . The best-fitting absorption column is  $3.6_{-0.4}^{+0.5} \times 10^{21}$  cm<sup>-2</sup>, in excess of the Galactic value of  $1.9 \times 10^{21}$  cm<sup>-2</sup> (Kalberla et al., 2005). The PC mode spectrum has a photon index of  $1.70_{-0.18}^{+0.20}$  and a best-fitting absorption column of  $2.3_{-0.4}^{+0.7} \times 10^{21}$  cm<sup>-2</sup>. The counts to observed (unabsorbed) 0.3–10 keV flux conversion factor deduced from this spectrum is  $4.6 \times 10^{-11}$  ( $6.0 \times 10^{-11}$ ) erg cm<sup>-2</sup> count<sup>-1</sup>.

A summary of the PC-mode spectrum is thus:

Total column:  $2.3^{+0.7}_{-0.4} \times 10^{21} \text{ cm}^{-2}$

Galactic foreground:  $1.9 \times 10^{21} \text{ cm}^{-2}$

Excess significance:  $<1.6$  sigma

Photon index:  $1.70^{+0.20}_{-0.18}$

The results of the XRT-team automatic analysis are available at

[http://www.swift.ac.uk/xrt\\_products/00537921](http://www.swift.ac.uk/xrt_products/00537921).

## 4 UVOT Observation and Analysis

The Swift/UVOT began settled observations of the field of GRB 121108A 64 s after the BAT trigger (Marshall et al., 2012). No optical afterglow consistent with the XRT position (Beardmore et al., 2012) is detected in the initial UVOT exposures. Preliminary 3-sigma upper limits using the UVOT photometric system (Breeveld et al., 2011) for the first finding chart (FC) exposure and subsequent exposures are:

Filter	Tstart (s)	Tstop (s)	Exposure (s)	Magnitude
white_FC	64	213	147	>20.9
u_FC	276	526	246	>20.5
white	64	1721	412	>21.3
v	605	1771	136	>19.6
b	531	1697	117	>19.9
u	276	1672	362	>20.6
w1	655	1814	129	>19.6
m2	1429	1623	39	>19.6
w2	581	1747	136	>19.8

Table 1: Magnitudes and limits from UVOT observations

The magnitudes in the table are not corrected for the Galactic extinction due to the reddening of  $E(B-V) = 0.37$  in the direction of the burst (Schlegel et al., 1998).

## References

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Kalberla, P. M. W., Burton, W. B., Hartmann, D., et al. 2005, *A.& A.*, 440, 775

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